

CLAIMS

What is claimed is:

1. A method of immobilizing at least one molecule in a silica matrix, comprising: combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative to form a biosilicification product comprising the at least one molecule immobilized in a silica matrix.
2. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining silicic acid with the at least one silaffin polypeptide and the at least one molecule.
3. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining at least one silaffin polypeptide selected from the group consisting of Sill protein, a fragment of the Sill protein, a synthetic polypeptide capable of precipitating silica, and poly-L-lysine with the at least one molecule and the at least one hydroxylated water-soluble derivative.
4. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining at least one silaffin polypeptide selected from the group consisting of a polypeptide having an amino acid sequence of SEQ ID NO:1, SEQ ID NO:2, SEQ ID NO:3, SEQ ID NO:4, SEQ ID NO:5, SEQ ID NO:6, and SEQ ID NO:7 with the at least one molecule and the at least one hydroxylated water-soluble derivative.
5. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining a silaffin polypeptide having an amino acid sequence of SEQ ID NO:1 with the at least one molecule and the at least one hydroxylated water-soluble derivative.

6. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining at least one organic molecule or at least one inorganic molecule with the at least one silaffin polypeptide and the at least one hydroxylated water-soluble derivative.

7. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining at least one molecule selected from the group consisting of an enzyme, a protein, a polypeptide, an antibody, an antigen, poly(nucleic) acids, microbial cells, plant cells, and animal cells with the at least one silaffin polypeptide and the at least one hydroxylated water-soluble derivative.

8. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining an enzyme selected from the group consisting of a hydrolase, a catalase, and an esterase with the at least one silaffin polypeptide and the at least one hydroxylated water-soluble derivative.

9. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining an enzyme selected from the group consisting of butyrylcholinesterase, horseradish peroxidase, and catalase with the at least one silaffin polypeptide and the at least one hydroxylated water-soluble derivative.

10. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining a magnetic material or a semiconductor material with the at least one silaffin polypeptide and the at least one hydroxylated water-soluble derivative.

11. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining an inorganic material selected from the group consisting of cobalt platinum, iron oxide, titanium dioxide, cadmium selenide, cadmium sulfide, cadmium telluride, zinc selenide, zinc sulfide, and zinc telluride with the at least one silaffin polypeptide and the at least one hydroxylated water-soluble derivative.

12. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises incorporating the at least one molecule into the silica matrix as the biosilicification product is formed.

13. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises forming the silica matrix and immobilizing the at least one molecule within the silica matrix substantially simultaneously.

14. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises forming the biosilicification product in which the at least one molecule is immobilized in the silica matrix.

15. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining the at least one silaffin polypeptide, the at least one molecule, and the at least one hydroxylated water-soluble derivative at a pH ranging from approximately 5 to approximately 8.

16. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining the at least one silaffin polypeptide, the at least one molecule, and the at least one hydroxylated water-soluble derivative at a pH of approximately 7.

17. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining the at least one silaffin polypeptide, the at least one molecule, and the at least one hydroxylated water-soluble derivative at a temperature ranging from approximately 10°C to approximately 25°C.

18. The method of claim 1, wherein combining at least one silaffin polypeptide, at least one molecule, and at least one hydroxylated water-soluble derivative comprises combining the at least one silaffin polypeptide, the at least one molecule, and the at least one hydroxylated water-soluble derivative at ambient pressure.